PATENT COOPERATION TI. ATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION RELATING TO PRIORITY CLAIM

(PCT Rules 26bis.1 and 26bis.2 and Administrative Instructions, Sections 402 and 409)

To:

REINHOLD COHN AND PARTNERS
P.O. Box 4060
61040 Tel Aviv
ISRAËL

Date of mailing (day/month/year) 02 March 2000 (02.03.00)	
Applicant's or agent's file reference 121817.1 LK	**IMPORTANT NOTIFICATION**
International application No. PCT/IL99/00684	International filing date (day/month/year) 15 December 1999 (15.12.99)
Applicant ELECTRIC FUEL LIMITED et al	

The applicant is hereby **notified** of the following in respect of the priority claim(s) made in the international application.

1. ☐ **Correction of priority claim.** In accordance with the applicant's notice received on: , the following priority claim has been corrected to read as follows:

   ☐ even though the indication of the number of the earlier application is missing.
   ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

2. ☒ **Addition of priority claim.** In accordance with the applicant's notice received on: 26 January 2000 (26.01.00), the following priority claim has been added:

   US 10 February 1999 (10.02.99) 60/119,568

   ☐ even though the indication of the number of the earlier application is missing.
   ☐ even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

3. ☐ As a **result of the correction and/or addition** of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:

4. ☐ **Priority claim considered not to have been made.**

   ☐ The applicant failed to respond to the Invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
   ☐ The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
   ☐ The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.

   The applicant may, before the technical preparations for international publication have been completed and subject to the payment of a fee, request the International Bureau to publish, together with the international application, information concerning the priority claim. See Rule 26bis.2(c) and the PCT Applicant's Guide, Volume I, Annex B2(IB).

5. ☐ In case where **multiple priorities** have been claimed, the above item(s) relate to the following priority claim(s):

6. A copy of this notification has been sent to the receiving Office and
   ☒ to the International Searching Authority (where the international search report has not yet been issued).
   ☒ the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Mougamadou ABIDINE
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TI ATY

From the INTERNATIONAL BUREAU

PCT

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The applicant is hereby **notified** of the following in respect of the priority claim(s) made in the international application.

1. [X] **Correction of priority claim.** In accordance with the applicant's notice received on: 26 January 2000 (26.01.00), the following priority claim has been corrected to read as follows:

US 15 April 1999 (15.04.99) 60/129,666

- [ ] even though the indication of the number of the earlier application is missing.
- [ ] even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

2. [ ] **Addition of priority claim.** In accordance with the applicant's notice received on: , the following priority claim has been added:

- [ ] even though the indication of the number of the earlier application is missing.
- [ ] even though the following indication in the priority claim is not the same as the corresponding indication appearing in the priority document:

3. [ ] As a **result of the correction and/or addition** of (a) priority claim(s) under items 1 and/or 2, the (earliest) priority date is:

4. [ ] **Priority claim considered not to have been made.**
   - [ ] The applicant failed to respond to the Invitation under Rule 26bis.2(a) (Form PCT/IB/316) within the prescribed time limit.
   - [ ] The applicant's notice was received after the expiration of the prescribed time limit under Rule 26bis.1(a).
   - [ ] The applicant's notice failed to correct the priority claim so as to comply with the requirements of Rule 4.10.

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5. [ ] In case where **multiple priorities** have been claimed, the above item(s) relate to the following priority claim(s):

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   - [X] to the International Searching Authority (where the international search report has not yet been issued).
   - [X] the designated Offices (which have already been notified of the receipt of the record copy).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Mougamadou ABIDINE
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(11) International Publication Number: WO 00/36688

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(30) Priority Data:

60/112,292	15 December 1998 (15.12.98)	US
60/119,568	10 February 1999 (10.02.99)	US
60/129,666	15 April 1999 (15.04.99)	US
09/293,927	15 April 1999 (15.04.99)	US
60/161,767	27 October 1999 (27.10.99)	US

(71) Applicant *(for all designated States except US)*: ELECTRIC FUEL LIMITED [IL/IL]; Western Industrial Park, P.O. Box 641, 99000 Bet Shemesh (IL).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: GIVON, Menachem [IL/IL]; Uziel Street 12, 58343 Holon (IL).

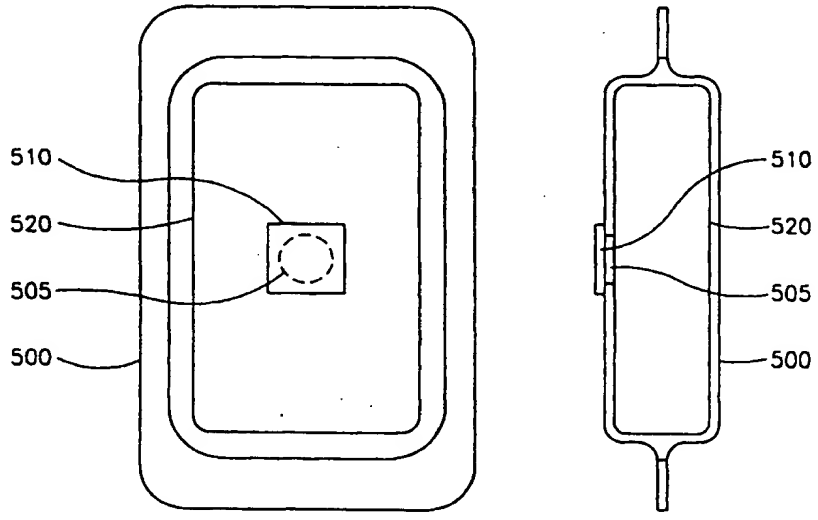
(74) Agent: REINHOLD COHN AND PARTNERS; P.O. Box 4060, 61040 Tel Aviv (IL).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: PACKAGING FOR METAL–AIR BATTERIES WITH HYDROGEN RELEASE VALVE



(57) Abstract

A packaging for metal–air batteries and devices with metal–air batteries. The packaging substantially restricts the ingress of oxygen into the packaging, as well as other undesirable elements such as water, dirt and carbon dioxide. The packaging also allows for the egress of hydrogen out of the packaging, which may be produced during the corrosion process of the metal anode. The packaging is made of an air–impermeable material with a one–way valve for the egress of hydrogen gas.

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PACKAGING FOR METAL-AIR BATTERIES WITH HYDROGEN RELEASE VALVE

Cross Reference to Related Applications

Priority is claimed to the following United States Patent Applications: serial number 60/161,767 filed on October 27, 1999, serial number 60/112,292 filed on December 15, 1998, serial number 60/129,666 filed on April 15, 1999, serial number 09/293,927 filed on April 15, 1999, and serial number 60/119,568 filed on February 10, 1999.

Field of the Invention

The present invention relates to packaging for storing metal-air battery cells and devices that contain metal-air battery cells. More particularly, the present invention relates to a packaging that substantially prevents water and other debris from entering the packaging and permits the release of hydrogen out of the packaging. The packaging also restricts the ingress of oxygen into the packaging.

Background of the Invention

Most high-drain portable electronic devices are powered by secondary or rechargeable batteries. Examples of such high-drain devices are cellular telephones, notebook computers, camcorders, and cordless hand-tools. The reason primary batteries are unattractive in such applications is that the life-span of a typical primary or single-use batteries is so short, and the cost so high, that they ultimately prove too costly for long-term use. In addition, their weight alone would discourage a person from carrying enough primary batteries for a long-term operation of the device. For example, a cellular telephone with alkaline batteries would last about as long as a single charge of a nickel-metal-hydride battery, but in the long term, cost far more per unit energy. A nickel-metal hydride battery, though initially expensive, costs only pennies to recharge.

New primary battery technologies have emerged that have, in principle at least, the ability to offer sufficient energy and power at a sufficiently low cost to make these batteries attractive for high-drain portable devices. One such technology is metal-air batteries, for example zinc-air batteries. In a zinc-air battery, one of the electrodes of the battery uses oxygen that can be supplied by ambient oxygen. Since oxygen is available everywhere, a zinc-air battery need house only one consumable electrode. Because of this, the energy

capacity per unit weight is magnified greatly. Unfortunately, the intrinsic benefits of electrochemical cells that use air as an electrode are attended by some serious technical problems.

One problem concerns the metal-air batteries needed for oxygen. Although zinc-air batteries have high energy densities, they are moderately low on power. To increase their power, large amounts of oxygen must be supplied. Increasing the batteries' access to oxygen is sometimes accomplished by designing the metal-air batteries or the housings that encase one or more metal-air batteries with relatively large and/or numerous openings. However, increasing the size and number of openings may also increase the likelihood that water and other debris may contact or enter the metal-air batteries. Increasing the size may also cause water vapor to leave the batteries, resulting in battery desiccation. Both of these occurrences may increase the likelihood that the battery will malfunction.

However, a metal-air battery's exposure to oxygen is preferable when the battery supplies energy, such as when a device connected to the battery is turned on. During non-use times, it is preferable for the battery to cut off from outside contaminates, as well as oxygen and carbon dioxide.

Another problem concerns the production of hydrogen. During operation and during storage of some metal-air batteries, the batteries may produce hydrogen due to the natural corrosion of a zinc oxide. During normal operation, the production of hydrogen can be released to the outside ambient air through the same openings by which oxygen and other gases enter the batteries. However, in the storage context, the competing interest of storing the batteries in an air tight enclosure to limit the batteries' exposure to carbon dioxide, oxygen, water and other debris may counter the need to release hydrogen from the enclosure. Enclosing the batteries in an air tight packaging may prevent the hydrogen from leaving the packaging and cause the packaging to expand and possibly burst.

Summary of the Invention

The present invention provides a package for encasing an electrochemical device requiring an ambient gas. The package has an enclosure capable of encasing the electrochemical device that is substantially impermeable to oxygen so that the ingress of oxygen into the packaging is restricted. Restricting access to oxygen may increase battery life. The packaging also permits the egress of hydrogen out of the packaging, which can build up during the storage of metal-air batteries. The package is made of a substantially air-

impermeable material that is sealed to enclose the device. A hole is formed in the packaging and that hole is covered with a one way valve sticker or other material that can be adhered to the packaging to restrict the flow of gases, water and other debris through the hole and into the packaging. The sticker also permits the diffusion of hydrogen gases out of the packaging so as to prevent the packaging from expanding to a volume that may cause the packaging to rupture. The material behaves as a one way valve for the release of gases out of the packaging.

The invention will be described in connection with certain preferred embodiments, with reference to the following illustrative figures so that it may be more fully understood.

With reference to the figures, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

Brief Description of the Drawings

FIG. 1 is a perspective view of a prismatic metal-air battery cell.

FIG. 2 is a set of illustrations from front and side of an embodiment of a packaging configuration.

Detailed Description of the Preferred Embodiment

Referring now to the drawings, as shown in FIG. 1, a metal-air battery cell 101 has a casing with holes 105 for the egress and ingress of air through the casing. The ingress of air is a necessary operation for the proper functioning of a metal-air battery cell 101. One or a multiple of the battery cells 101 can electrically connected and housed in a battery casing to form a battery pack.

Referring to FIG. 2, a gas impermeable bag 500 encloses a battery pack 520 holding at least metal-air battery cell. The bag 500 has a hole 505. The hole 505 is covered by a one way valve 510 to prevent the egress or ingress of air except through the one way valve 510. The one way valve 510 permits hydrogen gas to escape from the enclosure of the bag 500.

Hydrogen gas may be produced when the zinc anode of the metal-air battery cell corrodes. This hydrogen gas should be released from the bag to prevent the bag from expanding considerably and possibly causing the bag 500 to rupture. An example of a suitable one way valve is the product V45 Aromafine, which is made by Bosch® and is typically used for storing coffee. This one way valve 510 permits the release of hydrogen out of the bag 500 and prevents the flow of oxygen into the bag 500.

The gas impermeable bag 500 can made of a flexible plastic, a foil plastic laminate, or any other air impermeable material that protects the battery pack 520 from the outside environment. The one way valve 510 is attached to the bag 500 and covers the hole 505. The valve 510 is adhered to the bag through an adhesive, by thermally bonding the valve 510 to the bag 500, or by any other method that will form an air tight seal with the bag 500.

In the alternative, the one way valve 510 can be replaced with an air permeable sticker or alternative air permeable material. The air permeable sticker permits hydrogen gas diffuse out of the bag 500. The sticker also prevents water and other debris from entering the bag.

The following examples are descriptions of the use of the present invention. These examples are not meant to limit the scope of the invention, but are merely examples of specific embodiments.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

We claim:

1. A package for a metal-air battery comprising:

a gas impermeable enclosure with a valve communicating an interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

2. A package as in claim 1 wherein said valve is a one-way valve

3. A package as in claim 2 wherein said enclosure is formed of a flexible plastic.

4. A package as in claim 2 wherein said enclosure is formed of a foil/plastic laminate.

5. A package as in claim 2 wherein said valve prevents the ingress of fluid into said enclosure.

6. A package as in claim 2 wherein said enclosure prevents a pressure buildup in said enclosure.

7. A package as in claim 2 wherein said enclosure prevents the ingress of oxygen into said enclosure.

8. A package as in claim 1 wherein said enclosure is formed of a flexible plastic.

9. A package as in claim 1 wherein said enclosure is formed of a foil/plastic laminate.

10. A package as in claim 1 wherein said valve prevents the ingress of fluid into said enclosure.

11. A package as in claim 1 wherein said enclosure prevents a pressure buildup in said enclosure.

12. A package as in claim 1 wherein said enclosure prevents an ingress of oxygen into said enclosure.

13. A package for a metal-air battery comprising:

a substantially gas impermeable enclosure with an air permeable portion communicating an interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

14. A package as in claim 13 wherein said air permeable portion is an air permeable sticker attached to said enclosure.

15. A package as in claim 13 wherein said enclosure prevent the ingress of fluid into said enclosure.

16. A package as in claim 13 wherein said enclosure prevents a pressure buildup in said enclosure.

17. A package as in claim 13wherein said enclosure is formed of a flexible plastic.

18. A package as in claim 13 wherein said enclosure is formed of a foil/plastic laminate.

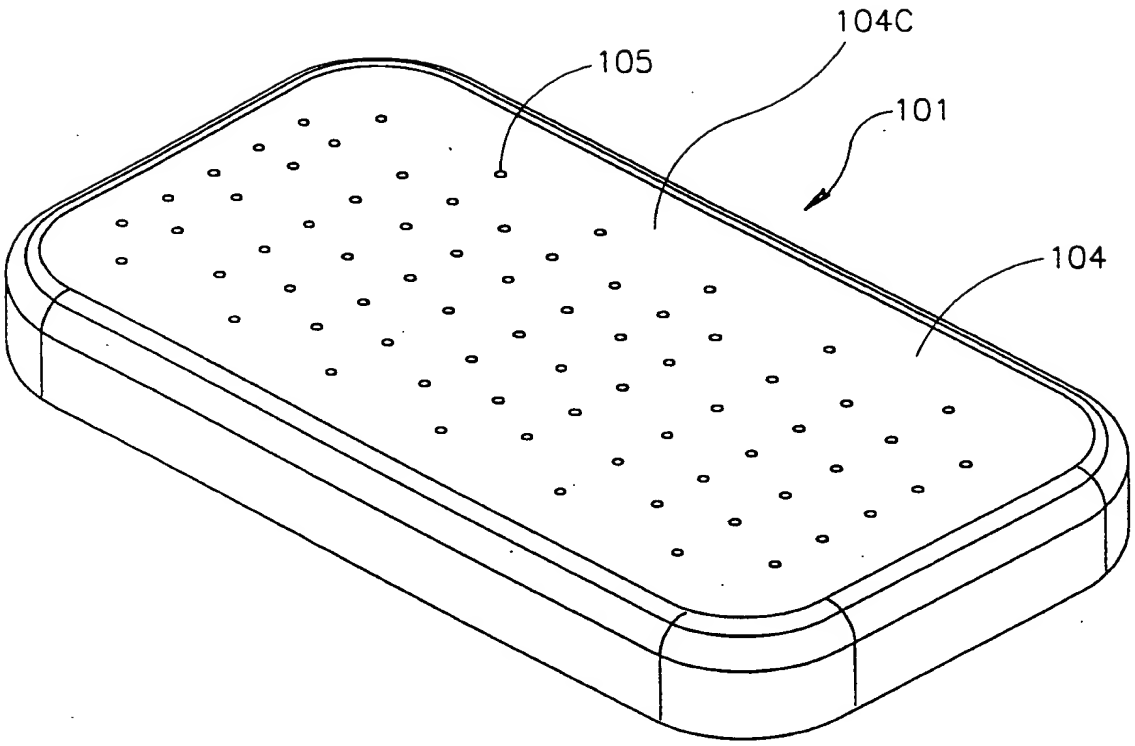

FIG.1

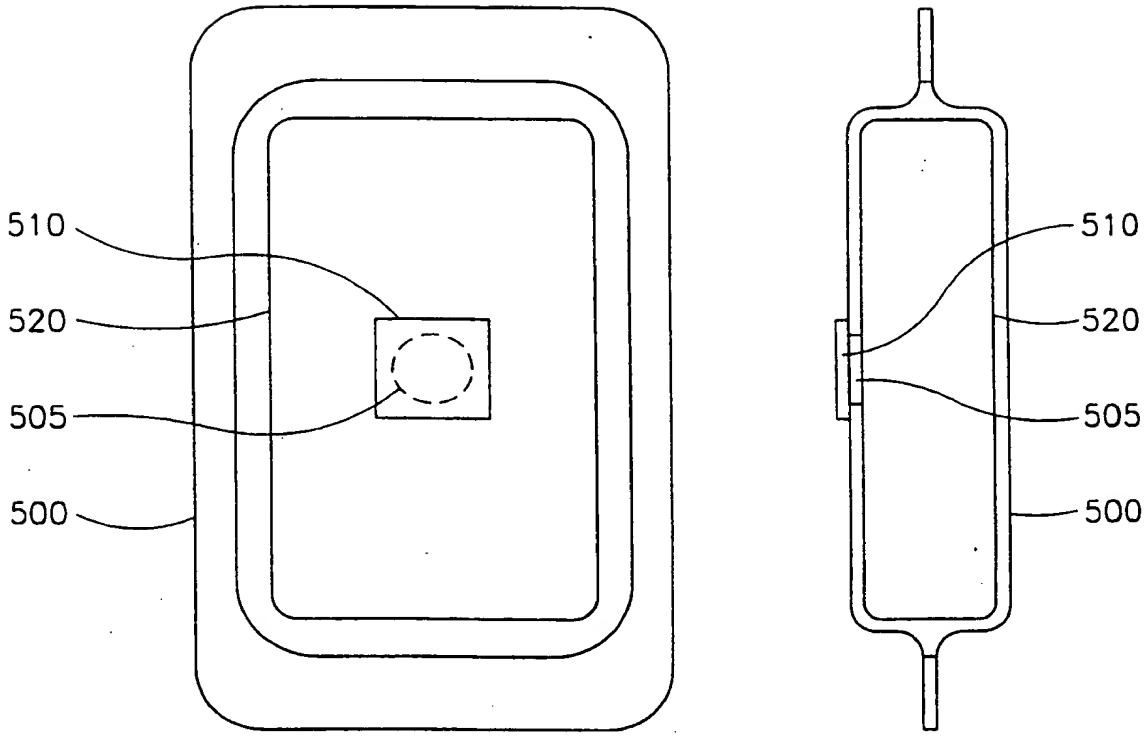

FIG.2

INTERNATIONAL SEARCH REPORT

Interna[illegible]l Application No
PCT/IL 99/00684

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01M12/06 H01M2/02 H01M2/10 H01M2/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 589 100 A (ELECTRIC FUEL LTD., JERUSALEM, IL) 30 March 1994 (1994-03-30) page 4, line 34 - line 40 page 6, line 30 -page 7, line 8 figures 1,2	1,2,5-7, 10-12
A		13-18
X	US 5 591 540 A (LOUIE EDMOND ET AL., LAWRENCVILLE, US) 7 January 1997 (1997-01-07) column 2, line 4 - line 60 column 5, line 18 - line 42 figures 1,6	1-3,5,6, 11
Y		13,15-18

-/---

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2000	27/03/2000

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 99/00684

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE WPI Section EI, Week 199551 Derwent Publications Ltd., London, GB; Class X16, AN 1995-398150 XP002133229 & JP 07 272704 A (JAPAN STORAGE BATTERY CO LTD), 20 October 1995 (1995-10-20) abstract	13,15-18
X	DE 21 08 847 A (ENERGY CONVERSION LTD., LONDON, GB) 30 September 1971 (1971-09-30) page 1, line 1 - line 4 page 2, line 17 - line 27 page 3, line 5 -page 4, line 2 figures 1-3	1,2,4-7, 9-12
A	US 4 278 744 A (ATHEARN LEE F., READING, US) 14 July 1981 (1981-07-14) column 1, line 10 - line 13 column 2, line 45 -column 3, line 8 figures 1,2,8	1,3,4,8, 9,13,15, 17,18
A	DE 16 71 452 A (LEESONA CORP., WARWICK, US) 26 August 1971 (1971-08-26) page 2, line 13 - line 22 column 4, line 7 -column 5, line 4 figures 1-3	1,3,4, 7-9,12, 13,15, 17,18

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna[redacted]al Application No
PCT/IL 99/00684

Patent document cited in search report	Publication dat	Patent family member(s)	Publication date
EP 0589100 A	30-03-1994	AT 146012 T	15-12-1996
		DE 69215676 D	16-01-1997
		DE 69215676 T	07-05-1997
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		JP 53013774 B	12-05-1978
		SE 350368 B	23-10-1972
		US 3531327 A	29-09-1970

PATENT COOPERATION TREATY 09/868272

From the:
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ISRAEL

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26-09-2000
REINHOLD COHN & PARTNERS

PCT

WRITTEN OPINION

(PCT Rule 66)

WO 19.12.2000 akv

Date of mailing *(day/month/year)*	19.09.2000
Applicant's or agent's file reference: 121817.1 LN	**REPLY DUE** **within 3 month(s)** from the above date of mailing

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL99/00684	15/12/1999	15/12/1998

International Patent Classification (IPC) or both national classification and IPC
H01M12/06

Applicant
ELECTRIC FUEL LIMITED et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain document cited
VII	☐	Certain defects in the international application
VIII	☒	Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 15/04/2001.

Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer / Examiner Haering, C Formalities officer (incl. extension of time limits) Koutsoftas, P Telephone No. +49 89 2399 7273

Form PCT/IPEA/408 (cover sheet) (January 1994)

I. **Basis of the opinion**

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

Description, pages:

1-4	as received on	24/02/2000

Claims, No.:

1-18	as received on	24/02/2000

Drawings, sheets:

1/2-2/2	as received on	24/02/2000

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. **Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-13 + 15-18: NO
Inventive step (IS)	Claims	14: NO
Industrial applicability (IA)	Claims	

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: EP-A-0 589 100
D2: US-A-5 591 540
D3: DE 21 08 847 A

A. Disclosures:

1. Document D1 discloses a vessel or package for zinc-air battery,
a. for the transport and storage, so implicitly gas impermeable,
b. providing at least one hydrogen vent (c.4, l.34-40 + Abstract).
c. It discloses a one-way vent or valve (c.5, l.28-31).
d. The package is made of polypropylene (c.6, l.41-44).
e. The valve prevents ingress of fluid into the device (c.5, l.28-36).
f. The package prevents pressure build-up (c.5, l.21-26), and
g. the ingress of oxygen into the enclosure (c.5, l.6-15).

2. Document D2 discloses a packaging for an electrochemical device
a. which is gas impermeable (c.2, l.12-31),
b. providing a vent or valve to allow gas to escape from the device (c.5, l.18-23).
c. It relates to a one-way vent or valve (c.5, l.18-23).
d. The packaging is made of a flexible plastic multilayer (c.2, l.12-31 + Abstract).
e. The valve prevents ingress of fluid into the device (c.5, l.18-23).
f. The packaging prevents pressure build-up (c.5, l.28-33), and
g. the ingress of oxygen into the enclosure (c.2, l.12-31).

3. Document D3 discloses a package for an electrochemical device (claim 1),
a. gas impermeable (p.2, l.17-27 + claim 1),
b. providing a vent or valve to allow H_2 to escape from the device (p.3, l.5-14 + claim 3).
c. It relates to a one-way vent or valve (p.3, l.10-14).
d. The packaging is made of a flexible plastic multilayer (p.3, l.20-30 + claim 5).
e. The valve prevents the ingress of fluid into the device (p.3, l.10-14).

f. The package prevents the ingress of oxygen into the enclosure (p.3, l.23-30).

B. Novelty:

1. The subject-matter of claim 1 is not novel under Article 33(1) and (3), considering the documents D1 to D3 (see 1.a. + b., 2.a. + b. and 3.a.+b.).
2. The subject-matter of claim 2 is not new, considering the 3 cited documents (see, 1.c., 2.c. and 3.c.).
3. The subject-matter of claims 3 is not new, considering said documents (see 1.d., 2.d. and 3.d.) and claim 4 is not new considering the documents D2 and D3 (2.d. and 3.d.).
4. The subject-matter of claim 5 is not new considering the three cited documents (see, 1.e., 2.e. and 3.e.).
5. The subject-matter of claim 6 is not new (see, 1.f. and 2.f.), considering D1 and D2.
6. The subject-matter of claim 7 is not novel either (see, 1.g., 2.g. and 3.f.), considering D1, D2 and D3.
7. Claims 3 to 7 refer to a package as in claim 2. The subject-matter of claim 2 as well as claim 1 is not new in regard of the three cited documents. Since claims 8 to 12 correspond to claims 3 to 7 respectively, but depend on claim 1 only, the subject-matter of those claims is a fortiori not new.
8. Claim 13 englobes claim 1 of which the subject-matter is not new. The subject-matter of that claim is therefore not new either. In fact, claim 13 is so broad in scope that any disclosure of a package with an aperture (air-permeable portion) would be novelty destroying for the subject-matter of this claim.
9. Finally, claims 15 to 18 depending on claim 13, of which the subject-matter is not new, correspond to the claims 5, 6, 3 and 4 respectively, of which the subject-matter is not new. Therefore the subject-matter of those claims is not new either.

C. Inventive step:

In claim 14, the air permeable portion of the enclosure is a simple sticker which is "attached" to the enclosure. It seems clear for the person skilled to put, stick, or more generally attach, an air permeable sticker, or any membrane, on the whole of the air-tight enclosure, to obtain an air-tight enclosure having an air permeable portion. Moreover, the problem to be solved is the capability for the air tight enclosure to prevent the ingress of any impurity (gas or else) in the battery, and simultaneously

to permit the egress of excessive gas in the battery and so avoid a pressure buildup. Thus, the subject-matter of claim 14 lacks inventive step.

D. At this stage of the examination, it is not clear which part of the present application could be used as a basis of an invention. However, if the applicant does not agree with the opinion of the examining division, he is demanded to send a new set of claims and giving his reasons, taking into account the above and below comments,. In order to facilitate the examination of the conformity of the amended application with the requirements of Article 34(2)(b) PCT, the applicant is requested to clearly identify the amendments carried out, no matter whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based (see also Rule 66.8(a) PCT).
If the applicant regards it as appropriate these indications could be submitted in handwritten form on a copy of the relevant parts of the application as filed.

Re Item VIII
Certain observations on the international application

Clarity:

1. The claims have to be rewritten in a more concise form (Rule 6 PCT) for the following reasons;

a. Claims 2 to 7 correspond to the claims 8 to 12,
b. Claim 13 includes claim 1,
c. Claims 15 to 18 correspond to the claims 5, 6, 3 and 4.

2. In claims 6 and 10, it is claimed that the enclosure prevents a pressure buildup. Howver, it is clear from the description (p.3, l.4-7), that the pressure buildup is prevented by the release of excessive gases (in fact H_2) through the valve, like in claim 16. therefore the term "enclosure" in claims 6 and 10 should be replaced by "valve". In any event, claim 6 (as well as claims 5, 7, 10-12, 15 and 16) attempts to define the subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem. The technical features necessary for

achieving this result should be added. Thus, those claims do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined.

3. It is not clear for the person skilled which advantage the use of an air permeable sticker as claimed in claim 14. Indeed, this sticker is attached on an air-tight enclosure. The advantage of the air tight enclosure is to avoid the ingress of air and other impurities inside the enclosure. The advantage of using a valve is to permit the egress of hydrogen from the enclosure, and to prevent the ingress of any impurity from ouside the enclosure. So the examiner does not see the point of using a sticker which would permit the ingress of air.

4. "Foil/plastic laminate" should be replaced by "foil or plastic laminate".

5. On p.4, l.20 of the description, "spirit" is not allowed and should be deleted. Indeed, the relative term used has no well-recognised meaning and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition unclear (Article 6 PCT).

PATENT COOPERATION TREATY 09/868272

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

REINHOLD COHN AND PARTNERS
P.O. Box 4060
61040 Tel-Aviv
ISRAEL

RECEIVED
12-02-2001
REINHOLD COHN AND PARTNERS

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	07.02.2001
Applicant's or agent's file reference 121817.1 LN	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL99/00684	15/12/1999	15/12/1998

Applicant
ELECTRIC FUEL LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Myers, J Tel.+49 89 2399-8111

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
121817.1 LN		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL99/00684	15/12/1999	15/12/1998
International Patent Classification (IPC) or national classification and IPC H01M12/06		
Applicant ELECTRIC FUEL LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
09/07/2000	07.02.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Haering, C Telephone No. +49 89 2399 8010

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IL99/00684

I. Basis of th report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

1-3	as originally filed	
4	with telefax of	19/12/2000

Claims, No.:

1-20	with telefax of	19/12/2000

Drawings, sheets:

1/2,2/2	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-13,15-20
Inventive step (IS)	Yes:	Claims	
	No:	Claims	14
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations
   see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re It m V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: DE 21 08 847 A
D2: EP-A-0 589 100
D3: US-A-5 591 540
D4: XP002133229 & JP 07 272704 A
D5: US-A-4 278 744
D6: DE 16 71 452 A

A. Disclosures:

1. Document D1 discloses a package for a metal-air battery (page 2, line 10-17, i.e. second paragraph + p.2, l.25-30, i.e. 4th §),
which is completely sealed against leakage of electrolyte, the package being for further encapsulating the battery to prevent ingress of oxygen into the battery,

a. the package comprises a gas impermeable enclosure (p.2, l.25-30 = 4th §),
having a vent or valve to allow H_2 to escape from the device (p.3, l.7-11, i.e. 3rd § + p.3, l.13-17, i.e. 4th §).

b. D1 relates to a one-way vent or valve (p.3, l.13-17 = 4th §).

c. The package is made of a flexible plastic multilayer (p.3, l.24-30, second part of the 5th §).

d. The valve prevents the ingress of fluid into the device (p.3, l.19-24, first part of the 5th §).

e. The valve prevents a pressure buildup in the enclosure (p.3, l.19-24, first part of the 5th §)

f. The battery comprising such a package as described in 1.a. to 1.f. is also disclosed in D1 (title + claims 2 to 5).

2. Document D2 discloses a vessel or package for the chemicals of a zinc-air battery, **but not for a completed battery** (p.5, l.1-5).

3. Document D3 discloses an internal packaging for an electrochemical device, and **not an external packaging for a metal-air battery** (c.2, l.12-31).

4. Document D4 discloses an **air permeable** package for an electrochemical device.
5. Documents D5 and D6 are defining the general state of the art and are therefore not considered to be of particular relevance.

B. Novelty:

The examiner considers that only D1 is relevant to the question of novelty of the present application, whereas the other documents D2 to D6 of the search report are not (see A.2. to A.5.).

1.a. The subject-matter of claim 1 is considered as not novel under Article 33(1) and (2) PCT (see A.1.a.).
1.b. For the same reason as in 1.a., the subject-matter of claim 13 is considered as not novel (see also Item VIII, 1.c.).
1.c. The subject-matter of claim 19 is considered as not novel (see A.1.f.), and because the battery is characterised in that it comprises a package with less technical features than in claim 1, thus a package at least as claimed in claim 1.
1.d. Similarly, the subject-matter of claim 20 is considered as not novel (see A.1.f.).

2. The subject-matter of claim 2 is not novel (see A.1.b.).
3. The subject-matter of claims 3 and 4 is not novel (see A.1.c.).
4. The subject-matter of claim 5 is not novel (see A.1.d.).
5. The subject-matter of claim 6 is not novel (see A.1.e.).
6. The subject-matter of claim 7 is not novel either (see, A.1.a. and Item VIII1.b.).
7. Claims 3 to 7 refer to a package as in claim 2. The subject-matters of claim 2 and claim 1 are not novel. Since claims 8 to 12 correspond to claims 3 to 7 respectively (see Item VIII, 1.a.), but depend on claim 1 only, the subject-matter of those claims is a fortiori not novel.
8. Finally, claims 15 to 18 depending on claim 13, of which the subject-matter is not novel, correspond to the claims 5, 6, 3 and 4 respectively (see item VIII, 1.d.), of which the subject-matter is not novel. Therefore the subject-matter of those claims is also not novel.

C. Inventive step:

In claim 14, the air permeable portion of the enclosure is a sticker which is "attached" to the enclosure.

The problem to be solved is the capability for the air tight enclosure to prevent the ingress of any impurity (gas or else) in the battery, and simultaneously to permit, via an air permeable portion, the egress of excessive gas in the battery and so avoid a pressure buildup or a rupture of the enclosure.

That problem is solved in D1, wherein the enclosure has a valve which fulfils the above mentioned function (page 2, line 25-30 + p.3, l.7-11).

In the present application, the sticker is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed, since the person skilled would put, stick, or more generally attach, an air permeable sticker, or any membrane, on the the air-tight enclosure, to obtain an air-tight enclosure having an air permeable portion.

Thus, the subject-matter of claim 14 lacks inventive step under Article 33(1) and (3) PCT.

D. At this stage of the examination, it is not clear which part of the present application could be used as a basis of an invention for the corresponding European Application. However, if the applicant does not agree with the opinion of the examining division, he is demanded to send in the regional phase a new set of claims and giving his reasons, taking into account the above and below comments,.

In order to facilitate the examination of the conformity of the amended application with the requirements of Article 34(2)(b) PCT, the applicant is requested to clearly identify the amendments carried out, no matter whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based (see also Rule 66.8(a) PCT).

If the applicant regards it as appropriate these indications could be submitted in handwritten form on a copy of the relevant parts of the application as filed.

Re Item VIII

Certain observations on the international application

1. The claims are not written in a concise form (Rule 6 PCT), for the following reasons;

a. Claims 3 to 7 correspond to the claims 8 to 12, with the difference that they depend on claim 2 wherein the valve is a one way valve. Thus claims 3 to 7 can be rendered dependent on claim 1 and/or 2, and consequently claims 8 to 12 can be deleted;

b. in claim 1, the storage package is said to prevent ingress of oxygen into the battery, and comprises a gas impermeable enclosure with a valve. Thus, that enclosure also prevents the ingress of oxygen. Therefore the subject-matter of claims 7 (and 12) is already included in claim 1. Those redundant claims should therefore be deleted;

c. the examiner is the opinion that claim 13 includes claim 1, since an air permeable portion, effective to permit the egress of hydrogen from the inside to the outside of the enclosure, can be a valve;

d. claims 15 to 18 depend on claim 13, and claim 13 includes claim 1. Thus, the subject-matter only of those claims includes to the subject-matter of claims 5, 6, 3 and 4 respectively.

2. It is not clear for the person skilled which advantage the use of an **air permeable sticker** as claimed in claim 14. Indeed, this sticker is attached on an air-tight enclosure. The advantage of the air tight enclosure is to avoid the ingress of air and other impurities inside the enclosure. The advantage of using a valve is to permit the egress of hydrogen from the enclosure, and to prevent the ingress of any impurity from ouside the enclosure. So the examiner does not see the point of using a sticker which would permit the ingress of air.

Hydrogen gas may be produced when the zinc anode of the metal-air battery cell corrodes. This hydrogen gas should be released from the bag to prevent the bag from expanding considerably and possibly causing the bag 500 to rupture. An example of a suitable one way valve is the product V45 Aromafine, which is made by Bosch® and is typically used for storing coffee. This one way valve 510 permits the release of hydrogen out of the bag 500 and prevents the flow of oxygen into the bag 500.

The gas impermeable bag 500 can made of a flexible plastic, a foil plastic laminate, or any other air impermeable material that protects the battery pack 520 from the outside environment. The one way valve 510 is attached to the bag 500 and covers the hole 505. The valve 510 is adhered to the bag through an adhesive, by thermally bonding the valve 510 to the bag 500, or by any other method that will form an air tight seal with the bag 500.

In the alternative, the one way valve 510 can be replaced with an air permeable sticker or alternative air permeable material. The air permeable sticker permits hydrogen gas diffuse out of the bag 500. The sticker also prevents water and other debris from entering the bag.

The following examples are descriptions of the use of the present invention. These examples are not meant to limit the scope of the invention, but are merely examples of specific embodiments.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

CLAIMS

1. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a gas impermeable enclosure with a valve communicating an interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

2. A package as in claim 1wherein said valve is a one-way valve.

3. A package as in claim 2 wherein said enclosure is formed of a flexible plastic.

4. A package as in claim 2 wherein said enclosure is formed of a foil or plastic laminate.

5. A package as in claim 2 wherein said valve prevents the ingress of fluid into said enclosure.

6. A package as in claim 2 wherein said valve prevents a pressure buildup in said enclosure.

7. A package as in claim 2 wherein said enclosure prevents the ingress of oxygen into said enclosure.

8. A package as in claim 1 wherein said enclosure is formed of a flexible plastic.

9. A package as in claim 1 wherein said enclosure is formed of a foil or plastic laminate.

10.A package as in claim 1 wherein said valve prevents the ingress of fluid into said enclosure.

11.A package as in claim 1 wherein said valve prevents a pressure buildup in said enclosure.

12.A package as in claim 1 wherein said enclosure prevents an ingress of oxygen into said enclosure.

13. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further

encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a substantially gas impermeable enclosure with an air permeable portion communicating an interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

14.A package as in claim 12 wherein said air permeable portion is an air permeable sticker attached to said enclosure.

15.A package as in claim 12 wherein said enclosure prevent the ingress of fluid into said enclosure.

16.A package as in claim 12 wherein said valve prevents a pressure buildup in said enclosure.

17. A package as in claim 12wherein said enclosure is formed of a flexible plastic.

18. A package as in claim 12 wherein said enclosure is formed of a foil or plastic laminate.

19. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having a valve communicating the interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

20. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a substantially gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having an air permeable portion communicating the interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

PATENT COOPERATION TREATY

PCT

09/868272

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
121817.1 LK		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IL 99/ 00684	15/12/1999	15/12/1998

Applicant

ELECTRIC FUEL LIMITED et al.

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from th date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with th abstract is Figure N . 2

   [X] as suggested by the applicant.

   [ ] None of the figures.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 99/00684

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01M12/06 H01M2/02 H01M2/10 H01M2/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 589 100 A (ELECTRIC FUEL LTD., JERUSALEM, IL) 30 March 1994 (1994-03-30) page 4, line 34 - line 40 page 6, line 30 -page 7, line 8 figures 1,2	1,2,5-7, 10-12
A		13-18
X	US 5 591 540 A (LOUIE EDMOND ET AL., LAWRENCVILLE, US) 7 January 1997 (1997-01-07) column 2, line 4 - line 60 column 5, line 18 - line 42 figures 1,6	1-3,5,6, 11
Y		13,15-18

-/—

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2000	27/03/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Peis, S

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Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE WPI Section EI, Week 199551 Derwent Publications Ltd., London, GB; Class X16, AN 1995-398150 XP002133229 & JP 07 272704 A (JAPAN STORAGE BATTERY CO LTD), 20 October 1995 (1995-10-20) abstract	13,15-18
X	DE 21 08 847 A (ENERGY CONVERSION LTD., LONDON, GB) 30 September 1971 (1971-09-30) page 1, line 1 - line 4 page 2, line 17 - line 27 page 3, line 5 -page 4, line 2 figures 1-3	1,2,4-7, 9-12
A	US 4 278 744 A (ATHEARN LEE F., READING, US) 14 July 1981 (1981-07-14) column 1, line 10 - line 13 column 2, line 45 -column 3, line 8 figures 1,2,8	1,3,4,8, 9,13,15, 17,18
A	DE 16 71 452 A (LEESONA CORP., WARWICK, US) 26 August 1971 (1971-08-26) page 2, line 13 - line 22 column 4, line 7 -column 5, line 4 figures 1-3	1,3,4, 7-9,12, 13,15, 17,18

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IL 99/00684

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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Dr. Reinhold Cohn
1899-1973

Ilan Cohn
PhD Biol.

David Gilat
B.Sc. Chem., LL.B, Adv.

Jonathan J. Topper
M.A. Elec. Eng.

Ehud Hausman
M.Sc. Comp. Sci.

David de Vries
B.Sc. Mech. Eng.

Ena Pugatsch
M.Sc. Opt. Mech. Eng.

Tamar Gallily
M.Sc. Biol.

Jonathan Patinkin
M.Sc. Biochem.

Bossmat Gonen
PhD Biol.

Svetlana Shtadler
M.Sc. Phys.

Ben Spungin
PhD Biol. and Maths.

Shulamit Hirsch
PhD Chem.

Ronit Barzik-Soffer
LL.B., Adv.

Yigal Fraenkel
PhD Chem.

Rotem Geva-Singer
LL.B., Adv.

Tamar Morag-Sela
M.Sc. Chem.

Shelly Zohar
LL.B., Adv.

Michael Ebert
B.Sc. Elec. Eng., LLB., US Patent Attorney

Deborah Vincze
LL.B. Adv. (Mexico)

Odelia Warshavsky Or-Paz
LL.M., Adv.

Shoshana Kessel
Info. Scientist

Gil Zecler
CFO

Kimberly Lindy
Executive Director

Michael Cohn
PhD Patent Attorney Consultant

Israel Shachter
B.Sc. Patent Attorney, EPA Consultant

Uri F. Gronemann
PhD Elec. Eng. Scientific Adviser

Reinhold Cohn House
21 Ahad Ha'am St.
Tel Aviv 65151 Israel

Postal Address:
P.O.B. 4060 Tel Aviv
61040 Israel
Tel: + 972 3 7109333
Fax: + 972 3 5606405
+ 972 3 5663782

Jerusalem Office:
Tel: + 972 2 6595570/1

Website:
www.rcip.co.il
e-Mail:
info@rcip.co.il

RC&P
Established 1934
Reinhold Cohn & Partners
Patent Attorneys

December 19, 2000

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Attention: Haering, C. -Examiner
Koutsoftas, P. – Formalities Officer

Re: PCT Patent Application No. PCT/IL99/00684
Applicant: Electric Fuel Limited
Response to Written Opinion dated September 19, 2000
Our Ref.: 121817.1-YF

We refer to the Written Opinion of September 19, 2000. Please find attached (and enclosed in triplicate with the postal confirmation copy to follow) amended pages 4, 5 and 6 where part of claims 1, 4, 6, 9, 11, 13, 16 and 18 have been amended and new claims 19 and 20 added. In addition we enclose original pages 4, 5 and 6 with the hand-written amendments incorporated therein.

1. Claim amendments:

Original claims 1 and 13 were amended so as to define the invention and more clearly distinct these two independent claims from the prior art.

Claims 6, 11 and 16: the word "enclosure" was substituted by "valve".

Claims 4, 9 and 18 the term "foil/plastic" was amended to "foil or plastic".

Newly added independent claims 19 and 20 recite the subject matter of the invention

2. Response to the Objections of Lack of Novelty and Lack of Inventive Step

In paragraph **V** of the Written Opinion, references D1-D3 were cited as the basis for rejecting the novelty of claims 1-13 and 15-18. The inventive step of claim 14 was rejected based on the contention that "attaching" a sticker is obvious. These rejections are respectfully traversed in view of the following analysis of the cited prior art.

Prior to setting our arguments we would like to emphasize the role of oxygen in a metal-air battery. It should be understood that metal-air batteries need oxygen for their function. Therefore such batteries are designed sometimes with holes for allowing oxygen to ingress. The holes have to be designed such that on one hand they will allow oxygen to ingress but on the other hand prevent leakage of electrolytes from the cell and further prevent the evaporation of water vapor therefrom. Such an exposure of the metal-air battery to oxygen is desirable only when it functions. When non-functioning the exposure to oxygen and other gases shortens the lifetime of the battery and therefore undesirable.

Document D1: We contend that this document is not relevant to the novelty of the present invention. This document, being a prior publication of the same applicant, describes a container for the contents of an electric cell. This document describes means for the transport of, and a storage vessel containing the components serving as electrical fuel for a zinc-air battery. Page 5, lines 1-5 of D1 summarize the invention by stating

"*Thus the present invention provides both means for (a) storing/transporting cassettes containing slurry and (b) storing/transporting the slurry in bulk for on-site filling of cassettes with charged slurry, or off-loading spent slurry from cassettes.*"

In other words D1 deals with a container for the chemicals of a metal-air battery, which is a container for the contents of a cell but not for a completed battery. In contrast, the present invention deals with the outer casing of a completed battery. Put in other words, the present invention deals with the outer casing intended for storing an intact metal-air battery prior to its use. Thus the metal-air battery is manufactured and stored in a package completely sealed against leakage of electrolytes therefrom, however, the package contains holes for exchange of gases. Oxygen needed for its function can enter the cell and hydrogen, which is formed internally, may be vented to the outside. The entire completely sealed package, in order to prolong its shelf life, is put prior to its use in a gas impermeable enclosure and this gas impermeable enclosure is the core of the present invention.

Document D2: We contend that this document is also not relevant to the novelty of the present invention. As written in column 1, lines 35-42 this publication deals with a "*new packaging material for an energy source... the material must not react with the chemical system of the energy storage device and should resist attack from common solvents*". As explained above the present invention does not deal with the internal packaging but rather with the external packaging.

Document D3: This document deals with a battery casing, not with a container for the contents of the cell. Thus the casing prevents the ingress of fluid into the cell as well as the ingress of oxygen. However it does not deal with a package enclosing the casing, i.e. an intact battery, which is meant for storing a metal-air battery so as to prolong its shelf life during non-use.

Inventive step

Claim 14 defines the gas impermeable enclosure of claim 13 as having an air permeable portion. The sticker claimed therein serves as a safe pressure release mechanism for the case of build up of hydrogen pressure inside the enclosure. In such a case the pressure may be vented through the sticker rather than rupture the entire enclosure.

3. Response to the Comments Re Item VIII

1.a: Relating to claims 3 to 7 (we think the Examiner meant claim 3), these claims do not correspond to claims 8 to 12. Claims 3-7 relate to claim 2, where the valve is a one-way valve while claims 8-12 relate to claim 1 where the valve is not necessarily a one-way valve. For example, according to claim 1, hydrogen may be vented from the enclosure by a symmetrical pressure relief valve, and not necessarily via the one-way valve of claim 2.
1.b: Claim 13 does not include claim 1. Claim 13 is directed to a secondary enclosure that is substantially gas-impermeable with no openings, except the air permeable portion for release of hydrogen. Claim 1 on the other hand deals with a gas impermeable enclosure having a valve communicating the interior and the outside of the enclosure in a selective and predetermined path.
1.c: claims 15-18 relate to claim 13, hence they do not correspond to claims 5, 6, 3 and 4.

2. Claims 6, 11 (we assume the Examiner meant 11) and claim 16 as well were amended according to the Examiner's comment, for which we thank.

4. The term "foil/plastic laminate" in claims 4, 9 and 18 was reworded to "foil or plastic laminate".

6. The word "spirit" was omitted from the description.

The Examiner is requested to reconsider the objections in light of the submissions made, and a favorable International Preliminary Examination Report (IPER) is requested. However, against the event that the Examiner still has some outstanding objections to the claims, the issuance of a second Written Opinion before the IPER issues is requested.

Yours very truly,
REINHOLD COHN AND PARTNERS
By:

Dr. Yigal Fraenkel

Enc: air mail

NEW AMENDED PAGES 4, 5 AND 6

Hydrogen gas may be produced when the zinc anode of the metal-air battery cell corrodes. This hydrogen gas should be released from the bag to prevent the bag from expanding considerably and possibly causing the bag 500 to rupture. An example of a suitable one way valve is the product V45 Aromafine, which is made by Bosch® and is typically used for storing coffee. This one way valve 510 permits the release of hydrogen out of the bag 500 and prevents the flow of oxygen into the bag 500.

The gas impermeable bag 500 can made of a flexible plastic, a foil plastic laminate, or any other air impermeable material that protects the battery pack 520 from the outside environment. The one way valve 510 is attached to the bag 500 and covers the hole 505. The valve 510 is adhered to the bag through an adhesive, by thermally bonding the valve 510 to the bag 500, or by any other method that will form an air tight seal with the bag 500.

In the alternative, the one way valve 510 can be replaced with an air permeable sticker or alternative air permeable material. The air permeable sticker permits hydrogen gas diffuse out of the bag 500. The sticker also prevents water and other debris from entering the bag.

The following examples are descriptions of the use of the present invention. These examples are not meant to limit the scope of the invention, but are merely examples of specific embodiments.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

CLAIMS

1. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a gas impermeable enclosure with a valve communicating an interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

2. A package as in claim 1wherein said valve is a one-way valve.

3. A package as in claim 2 wherein said enclosure is formed of a flexible plastic.

4. A package as in claim 2 wherein said enclosure is formed of a foil or plastic laminate.

5. A package as in claim 2 wherein said valve prevents the ingress of fluid into said enclosure.

6. A package as in claim 2 wherein said valve prevents a pressure buildup in said enclosure.

7. A package as in claim 2 wherein said enclosure prevents the ingress of oxygen into said enclosure.

8. A package as in claim 1 wherein said enclosure is formed of a flexible plastic.

9. A package as in claim 1 wherein said enclosure is formed of a foil or plastic laminate.

10.A package as in claim 1 wherein said valve prevents the ingress of fluid into said enclosure.

11.A package as in claim 1 wherein said valve prevents a pressure buildup in said enclosure.

12.A package as in claim 1 wherein said enclosure prevents an ingress of oxygen into said enclosure.

13. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further

encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a substantially gas impermeable enclosure with an air permeable portion communicating an interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

14.A package as in claim 12 wherein said air permeable portion is an air permeable sticker attached to said enclosure.

15.A package as in claim 12 wherein said enclosure prevent the ingress of fluid into said enclosure.

16.A package as in claim 12 wherein said valve prevents a pressure buildup in said enclosure.

17. A package as in claim 12wherein said enclosure is formed of a flexible plastic.

18. A package as in claim 12 wherein said enclosure is formed of a foil or plastic laminate.

19. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having a valve communicating the interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

20. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a substantially gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having an air permeable portion communicating the interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

ORIGINAL PAGES 4, 5 AND 6 INCLUDING THE HAND-WRITTEN AMENDMENTS

Hydrogen gas may be produced when the zinc anode of the metal-air battery cell corrodes. This hydrogen gas should be released from the bag to prevent the bag from expanding considerably and possibly causing the bag 500 to rupture. An example of a suitable one way valve is the product V45 Aromafine, which is made by Bosch® and is typically used for storing coffee. This one way valve 510 permits the release of hydrogen out of the bag 500 and prevents the flow of oxygen into the bag 500.

The gas impermeable bag 500 can made of a flexible plastic, a foil plastic laminate, or any other air impermeable material that protects the battery pack 520 from the outside environment. The one way valve 510 is attached to the bag 500 and covers the hole 505. The valve 510 is adhered to the bag through an adhesive, by thermally bonding the valve 510 to the bag 500, or by any other method that will form an air tight seal with the bag 500.

In the alternative, the one way valve 510 can be replaced with an air permeable sticker or alternative air permeable material. The air permeable sticker permits hydrogen gas diffuse out of the bag 500. The sticker also prevents water and other debris from entering the bag.

The following examples are descriptions of the use of the present invention. These examples are not meant to limit the scope of the invention, but are merely examples of specific embodiments.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

< A > which completely sealed against leakage of electrolyte therefrom, said storage package being for further encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package

CLAIMS

1. A storage package for a metal-air battery <A> comprising:

a gas impermeable enclosure with a valve communicating an interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

2. A package as in claim 1 wherein said valve is a one-way valve

3. A package as in claim 2 wherein said enclosure is formed of a flexible plastic.

4. A package as in claim 2 wherein said enclosure is formed of a ~~foil/plastic~~ foil or plastic laminate.

5. A package as in claim 2 wherein said valve prevents the ingress of fluid into said enclosure.

6. A package as in claim 2 wherein said ~~enclosure~~ valve prevents a pressure buildup in said enclosure.

7. A package as in claim 2 wherein said enclosure prevents the ingress of oxygen into said enclosure.

8. A package as in claim 1 wherein said enclosure is formed of a flexible plastic.

9. A package as in claim 1 wherein said enclosure is formed of a ~~foil/plastic~~ foil or plastic laminate.

10. A package as in claim 1 wherein said valve prevents the ingress of fluid into said enclosure.

11. A package as in claim 1 wherein said ~~enclosure~~ valve prevents a pressure buildup in said enclosure.

12. A package as in claim 1 wherein said enclosure prevents an ingress of oxygen into said enclosure.

13. A storage package for a metal-air battery < A > comprising:

a substantially gas impermeable enclosure with an air permeable portion communicating an interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

14. A package as in claim 13 wherein said air permeable portion is an air permeable sticker attached to said enclosure.

15.A package as in claim 13 wherein said enclosure prevent the ingress of fluid into said enclosure.

16.A package as in claim 13 wherein said ~~enclosure~~ valve prevents a pressure buildup in said enclosure.

17.A package as in claim 13wherein said enclosure is formed of a flexible plastic.

18.A package as in claim 13 wherein said enclosure is formed of a ~~foil/plastic~~ foil or Plastic laminate.